

EXECUTIVE SUMMARY

Ulysses' 3rd orbit of the Sun will begin in 2004. Important new observations in a different phase of the sunspot cycle and in the second half of the solar magnetic cycle can be made in this orbit. In the partially completed 2nd orbit, Ulysses has characterized the 3D heliosphere near solar maximum, helped develop techniques to map solar wind fields and particles back to their solar sources, carried out joint radio burst triangulation studies with Wind, determined properties of the local interstellar medium and magnetars, and revealed an important need for additional measurements relating to energetic particle dynamics in the 2nd half of the 22 year Hale solar magnetic cycle. In the rest of the 2nd orbit and in the 3rd orbit, Ulysses' goals include:

- Analyze energetic particle and dust dynamics in the 2nd half of the solar magnetic cycle, when the reversed field is expected to have a major effect on their latitude dependence.
- Determine whether the north-south heliospheric asymmetry discovered in the 1st orbit is systemic or coincidental.
- Answer open questions about the 3D topology and structure of CMEs and the heliospheric current sheet, in conjunction with in-ecliptic spacecraft.
- Determine the solar source for composition signatures of different solar wind states, in conjunction with in-ecliptic spacecraft.
- Characterize the 3D solar wind in the epoch of the Voyager encounter with the heliospheric termination shock. Extend the temporal baseline for measuring properties of the local interstellar medium to enable a search for time/spatial variations.
- Serve as the out-of-ecliptic detector for the triangulation of gamma ray bursts
- Make observations of opportunity, for example during the Jupiter distant encounter in 2004.

Ulysses will enhance these studies by collaborating with SOHO, Wind, ACE and the upcoming SDO, STEREO, and Solar-B missions. Ulysses furthermore provides data to several independently funded NASA studies. These demands have led the Ulysses Data System to become a fully and easily accessible, distributed data system. Ulysses has also been made part of the International Living With a Star Program, confirming its value in the study of Sun-Earth relations.

With its own continuing science objectives, through collaboration with other missions and programs, and through support of independent studies, Ulysses supports many Sun Earth Connections 2002 Roadmap research focus areas and investigations. Similarly, Ulysses science is well aligned with the Space Science Enterprise Strategic Plan.

The instruments themselves all continue to be fully operable and to return data. During the 3rd orbit, a core set of instruments would be continuously in operation with the remainder of the instruments operating during and around the rapid south-to-north transit at perihelion. The Radioisotope Thermal Generator will provide sufficient power for these operations. A technical study was carried out in 2002, demonstrating Ulysses' ability to continue scientific studies in the 3rd orbit and providing a detailed operation plan for the spacecraft under the requirement for some instrument power sharing near aphelion.

Recent scientific achievements are described in this proposal. An online database of publications provides further documentation of the Ulysses Team's productivity. Ulysses is already operating under a mission extension with a reduced budget. This budget provides no funds for joint studies with missions launched after the Ulysses mission began. It provides for only minimal data validation and verification. New missions have led to increasing demands for Ulysses data products. Therefore, two budgets are submitted here. The first is a minimal budget with essentially level funding that would keep Ulysses operating but not meet growing external demands. The minimal budget includes existing activities described in the E/PO supplement. The second is an optimal budget that includes a small supplement to develop new data products, carry out additional data validation and verification, to initiate collaborations with new missions, and expand the E/PO effort.

